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Natural time analysis of global seismicity: the identification of magnitude correlations.

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Natural time [1-6] can reveal novel dynamical features hidden behind the time series of complex systems, for a review see Ref.[7]. In a time series comprising N earthquakes, the natural time $\chi_k = k/N$ serves as an index for the occurrence of the k-th event[1, 5, 6], and is smaller than or equal to unity. In natural time analysis of seismicity, the evolution of the pair of two quantities (χ_k, E_k) is considered, where E_k denotes the energy emitted during the k-th earthquake. It has been proposed[5] that the variance κ_1 of natural time can play the role of an order parameter for seismicity. Moreover, when using natural time the identification of temporal correlations -even in the presence of heavy tails in the data- becomes possible[6]. Thus, natural time analysis enables the identification of magnitude correlations between successive earthquakes[8]. By analyzing in natural time[9] the worldwide seismicity from the Harvard Global Centroid Moment Tensor Catalog as reported by the United States Geological Survey as well as the most recent version (1900-2007) of the Centennial earthquake Catalog[10], we find non-trivial magnitude correlations for earthquakes of magnitude greater than or equal to 7.

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